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ABSTRACT

The original version of the "Helen Keller Story" and a linguistically more complex version of it were used to test the hypothesis that reading comprehension is affected by the complexity of linguistic structures. Complexity was measured by four readability measures, the mean number of words per T-unit, and the Schmidt-Kittrell Linguistic Complexity Scale, but none of these measures accurately reflected the relative complexity of the two versions. When 87 university students were tested on the two versions, using the cloze technique, however, significant differences were found, indicating that the complex version of the story was more difficult to comprehend. Samples of the structures that make the version more difficult are illustrated in the study. (Author/AA)

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WHAT MAKES READING DIFFICULT: THE COMPLEXITY OF STRUCTURES

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Reading comprehension appears to be effected by the complexity of the linguistic structures used in a passage (Goodman, 1967; Ruddell, 1963; Strickland, 1962; Pearson, 1974-1975). To test this hypothesis two versions of a story, "Helen Keller" (which appeared in the Released Exercises of the National Assessment of Education Progress (NAEP) Reading Data, 1975) were used. A Simple Version and a Complex Version were designed. Next three methods were used to measure the complexity of the stories. In addition, Cloze Versions (Simple Cloze Version/Complex Cloze Version) were designed and administered to check the complexity as a measure of reading comprehension.

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Part I: Applying Three Different Methods to Measure Complexity

In the first part of this study, three different methods were used to attempt to measure the complexity of the two versions of the "Helen Keller Story". (a) Readability formulas were used. Four formulas applied were as follows: Dale-Chall, Flesch, Fry, and Bormuth Readability. Readability formulas are frequently built on sentence length and a vocabulary measure. The formulas were used to determine whether differences in complexity between the Simple Version and the Complex Version would be reflected in readability scores. (b) Secondly, the mean number of words per T-unit were calculated. The T-unit has been defined as an independent clause with its dependent predications (Hunt, 1965). Some researchers have found the mean number of words per T-unit to be an effective measure of the complexity of writing (Hunt, 1965; O'Donnell, Griffin, and Norris, 1967; and O'Donnell, 1976). The mean number of words per T-unit increased as writing became more complex. (c) Thirdly, the Schmidt-Kittell Linguistic Complexity Scale was applied. When a study of the syntactic complexity of the spontaneous story-retell responses of 300 students to six different modes of story presentation was conducted (Schmidt, 1974), this Scale (S-KLCS) was sensitive in determining the linguistic complexity of oral and written retells. It appeared to measure within T-unit and inter-T-unit complexity more sensitively than mean number of words per T-unit. Thus it was applied to both versions of the "Helen Keller Story".

Method

The original version of the "Helen Keller Story" as released from NAEP was used as the Simple Version in this study. Next the researcher manipulated the syntax of the story to create a Complex Version. The basic vocabulary was

not changed. Prepositional phrases and participal phrases were preposed, noun structures were altered to use gerund forms; genitives were preposed; appositives and passive forms were used. Samples are given at the end of this paper.

1. Applying the Readability Formulas

Four different readability formulas were applied to determine the relative complexity of each version. The data is presented in Table 1.

Insert Table 1 about here

Grade-level scores varied between .2 and .5 grade-level points between the Simple and Complex Versions. The Complex Version was rated as slightly more complex when each scale was used. The designers of most readability scales call attention to the fact that the grade level obtained would be limited to being within approximately a year of the difficulty level of readers. If this statement is considered, then none of the readability scales used measured the relative complexity between the two versions of the story.

2. Applying the T-unit

The mean number of words per T-unit were computed to see if this might be an effective measure of the complexity of these two versions of the "Helen Keller Story". See the date in Table 2.

Insert Table 2 about here

Hunt found that as students mature from grades four to twelve they use more words per T-unit. The research of O'Donnell, Griffin, and Norris supported his data (O'Donnell, 1976). In this study, just the opposite effect

appeared. The Simple Version had more words per T-unit than did the Complex Version. T-unit length was shortened but the passage appeared to be more complex.

3. Applying the Schmidt-Kittell Linguistic Complexity Scale (S-KLCS)

To apply the Schmidt-Kittell Linguistic Complexity Scale, a numerical value was applied to each manipulation of the syntax. Anaphoric structures, preposing, postposing, unusual word orders, etc. were weighted. Then a syntactic complexity ratio was computed by dividing the total number of operations by the number of T-units. (A sample is included at the end of this paper.) The Mean Ratio Score of the Simple Version of the "Helen Keller Story" was 3.68 when the Schmidt-Kittell Linguistic Complexity Scale was applied; the Mean Ratio Score of the Complex Version was 4.34. These Mean Ratio Scores were significantly different ($df = 20$, $p < .01$). See Table 3.

Insert Table 3 about here

The Schmidt-Kittell Linguistic Complexity Scale appeared to be a sensitive tool to measure the differences in complexity between these two selections.

Summary of the Data

There appeared to be no differences between versions when measured by the four readability scales. The Complex Version was measured as only .2 to .5 grade-level points more complex on any of the readability formulas.

When the mean number of words per T-unit were computed, the mean T-unit length of the Complex Version, 13.09, was shorter than the mean T-unit length ofthe Simple Version, 15.74. This is the opposite of frequently-cited research.

The Schmidt-Kittell Linguistic Complexity Scale appeared to be a sensitive measure of the relative complexity between the two versions. To test this

senstivity, a cloze test of comprehension was set up using the Simple and the Complex "Helen Keller Stories".

Part II: Administering the Cloze Tests of Comprehension

The cloze technique was applied to both versions of the "Helen Keller Story" so that they could be used as tests of comprehension. Directions for making and taking the tests followed Bormuth (Page, 1975). The fifth word in each passage was deleted. The two versions (Simple Cloze Version/Complex Cloze Version) were then given to three classes of university students.

Two university classes were made up of senior education students enrolled in a reading/language arts course; the third class was made up of graduate students enrolled in a reading/language arts course. A total of 84 students were tested. Students were given the Cloze Tests prior to a lecture on the use of cloze as a measure of comprehension so that they could experience the taking of such a test. Either the Simple Cloze Version or the Complex Cloze Version was distributed to the students randomly. The cloze scores computed followed Bormuth as cited. Cloze scores for each university class are given in Table 4.

Insert Table 4 about here

While both versions were well within the range of scores which would indicate that comprehension was not difficult for university students, it is interesting to note that university students would drop from 11 to 17 cloze points when given the Complex Version. (Bormuth suggested a score of 44% right could be compared to instructional level on an informal inventory, while 62% could be compared with an independent level.) A 2x3 analysis of variance for

unequal N's (Winer, 1962) was applied to the data. See Table 5.

Insert Table 5 about here

The F score of 36.27 indicated highly significant differences between the two groups in cloze scores when comprehension was analyzed on the Simple and Complex Versions. No differences existed between classes (F = 2.28).

The Simple Version has been used in the NAEP data with fourth, eighth, and eleventh grade students. Only about half of the story was used at grade four, but it appeared to be at a relatively complex level of readability.

Conclusions and Implications

The results indicated that (a) the readability scales used in this study did not appear to measure the relative complexity between the two versions of the story, (b) mean number of words per T-unit did not measure the differences in complexity between the versions either, and (c) the Schmidt-Kittell Linguistic Complexity Scale appeared to be a sensitive measure of the linguistic complexity. This was supported by the performance of university students on the cloze comprehension tests; they demonstrated difficulty in comprehension as measured by cloze scores on the Complex Version.

What Structures Appeared to Make the Version Complex?

The researcher hypothesized that reading became more difficult because the reader processing language could not make sense out of the story; the reader could not comprehend it (Smith, 1975; Goodman, 1975). Pearson (1974-75) called for studies in which different versions of passages are constructed according to some rule-governed procedures with questions asked relevant to the structural changes effected. In this study, for one thing, the syntax was not as predictable

in the Complex Version. Secondly, the language was less redundant (Smith, 1975). Thirdly, more deletions occured; therefore, when the reader was processing the language there were less clues to enable the reader to get at the meaning. Fourthly, unusual grammatical structures were used. An example of a T-unit may help to clarify these four points.

Simple Version

"She also wrote many books and articles and included an
2 4 3 5 3 2 3 3 2 1 3 1

autobiography of her early years." 15 words, S-KLCS Ratio = 3.53
6 3 3 5 3

Complex Version

"Her writing, many books and articles, included an
3 5 1 2 5 3 2 3 3 1 1 3 1

autobiography of early years." 12 words, S-KLCS Ratio = 4.25
6 3 1 5 3

The underlined words were those deleted in the Cloze Tests. The numbers indicate the numerical weightings of the S-KLCS.

In the Complex Version, the common NV pattern was replaced with a possessive personal pronoun/gerund phrase, appositive phrase, verb. Elements of a relative clause "which were" were deleted to make the appositive phrase. The conjunctive was deleted; a comma was inserted. Other deletions included "also" and the possessive personal pronoun "her" which had identified whose "early years" were being discussed. The reader must process the gerund, "writing," acting as the subject of the verb "included" instead of the usual NV construction "she ... included". The deceivingly small changes in syntax and the use of only three less words appeared to make this T-unit much more complex to process.

Psycholinguistic analyses of how the reader may be processing complex linguistic structures is of real interest. The complexity of our language makes the complex process--reading, even more complex.

Table 1

Application of Four Readability Formulas to "Helen Keller Story"

Formula	Grade Level Scores	
	Simple Version	Complex Version
Dale-Chall	8.2	8.5
Flesch	9.6	10.0
Fry	9.5	10.0
Bormuth		
Frustration Level	9.4	9.7
Instruction Level	10.5	10.8
Independent Level	11.6	11.8

Table 2

Mean Number of Words Per T-Unit on the Simple and Complex Versions of "Helen Keller"

Scale	Versions	
	Simple Version	Complex Version
Mean number of words per T-Unit	15.64	13.09

Table 3

Schmidt-Kittell Linguistic Complexity Scale Mean Ratio Scores and *t* on the Simple and Complex Versions of "Helen Keller"

Scale	Version		*t*
	Simple Version	Complex Version	
Schmidt-Kittell Linguistic Complexity Scale Mean Ratio Scores	3.68	4.34	3.60*

*$df = 20$, $p < .01$

Table 4

Cloze Scores of University Seniors and Graduates on the Simple Cloze Version and the Complex Cloze Version of the "Helen Keller Story"

Classes	Version		Difference in Cloze Points
	Simple Version	Complex Version	
Summer '77 Graduates (N=32)	66.21	48.62	17.59
Autumn '76 Seniors (N=22)	69.50	57.80	11.70
Spring '76 Seniors (N-31)	70.39	55.23	15.16

Table 5

Analysis of Variance of Cloze Scores of University Seniors and Graduate Students on the Simple Cloze Version and Complex Version of "Helen Keller"

Source	SS	df	MS	F
A (Complexity)	4415.79	1	4415.79	36.27**
B (Classes)	556.04	2	278.02	2.28
AB	96.30	2	48.15	.40
Within cell	9617.65	79	121.74	

$F_{.95}(2,80) = 3.11$, **$F_{.99}(1,80) = 6.96$

APPENDIX

Some samples of relative complexity between the Complex Version and the Simple Version of the story:

		Version
NOMINALIZATION:	Illness resulted in loss of hearing ...	COMPLEX
	She lost her hearing as a result of illness ...	SIMPLE
PARTICIPALS:	Succeeding in arousing ... (PREPOSED)	COMPLEX
	Miss S succeeded in arousing ...	SIMPLE
GENITIVES:	Miss S spelled object's names ...	COMPLEX
	Miss S spelled the names of objects ...	SIMPLE
PASSIVES:	Speech lessons were begun ...	COMPLEX
	She began speech lessons ...	SIMPLE
GENITIVE:	elected the freshman class ('s) vice-president ...	COMPLEX
	elected the vice-president of her freshman class ..	SIMPLE
PARTICIPALS:	After graduating, she began studying ...	COMPLEX
	After graduation, Helen began to study (infinitive)	SIMPLE
	Touring the United States, she began studying ...	COMPLEX
	She toured the United States ...	SIMPLE
POSSESSIVE PERSONAL PRONOUN/GERUND:		
	Her writing, many books and articles included ...	COMPLEX
	She also wrote many books and articles, and included ...	SIMPLE

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